LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

UNITED STATES NATIONAL MUSEUM

Bulletin 100

VOLUME 6, PART 8

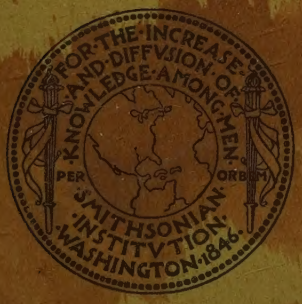
CONTRIBUTIONS TO THE BIOLOGY OF THE PHILIPPINE ARCHIPELAGO AND ADJACENT REGIONS

THE LAND SHELLS OF THE GENUS OBBA FROM MINDORO PROVINCE PHILIPPINE ISLANDS

BY

PAUL BARTSCH

Curator, Division of Mollusks and Cenozoic Invertebrates
United States National Museum



SMITHSONIAN INSTITUTION
WASHINGTON
D. C.

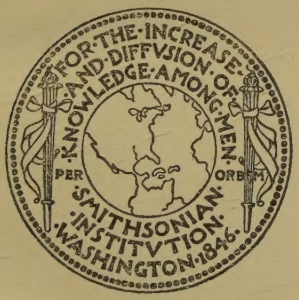
SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 100
VOLUME 6, PART 8

CONTRIBUTIONS TO THE BIOLOGY OF THE PHILIPPINE ARCHIPELAGO AND ADJACENT REGIONS

THE LAND SHELLS OF THE GENUS OBBA FROM MINDORO PROVINCE PHILIPPINE ISLANDS

BY

PAUL BARTSCH
Curator, Division of Mollusks and Cenozoic Invertebrates
United States National Museum



UNITED STATES
GOVERNMENT PRINTING OFFI
WASHINGTON : 1933

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - - - - Price 10 cents

RELIEF MAP OF MINDORO PROVINCE, PHILIPPINE ISLANDS, SHOWING LOCALITIES FROM WHICH SPECIMENS OF OBBA WERE OBTAINED

THE LAND SHELLS OF THE GENUS OBBA FROM MINDORO PROVINCE, PHILIPPINE ISLANDS

By Paul Bartsch

Curator, Division of Mollusks and Cenozoic Invertebrates, United States National Museum

Recent sendings to the United States National Museum of land mollusks from Mindoro Province, Philippine Islands, for identification have made it necessary to subject those belonging to the genus *Obba* to a critical review; the results thereof are expressed in the following pages.

Mindoro Province includes besides the main island a number of lesser isles and islets, and in order to get an adequate understanding of the distribution of the various races of the species here discussed, a relief map is here reproduced (pl. 87). It is hoped that this may stimulate collectors to search for these and other land shells on the small islands from which no mollusks have been reported. Such a search is sure to produce rich results.

KEY TO THE SPECIES OF OBBA REPORTED FROM MINDORO PROVINCE

Shell acutely keeled at the periphery.
- Periphery with a dark band---------- **gallinula.**
- Periphery without a dark band---------- **listeri.**

Shell not acutely keeled at the periphery.
- Shell angulated or rounded at the periphery.
  - Periphery with a dark zone---------- **subhorizontalis.**
  - Periphery without a dark zone.
    - Conspicuous brown marking absent---------- **sarcochroa.**
    - Conspicuous brown marking not absent.
      - Subsutural interrupted brown band present---------- **mesai.**
      - Subsutural interrupted brown band absent.
        - Upper surface very rough---------- **marmorata.**
        - Upper surface not very rough.
          - Upper surface rather smooth---------- **planulata.**

OBBA GALLINULA BARTHELOWI, new subspecies

Plate 88, Figure 1

The shell is lenticular, strongly carinated at the periphery, rather broadly umbilicated. The nuclear whorls are flesh-colored; postnuclear whorls of pale horn-colored ground color with a broad zone halfway between the summit and the periphery, and a rather broader peripheral zone of brown, which extends both on the upper and lower surfaces in equal width and an almost median basal band, which is

about twice as wide as that on the spire. In addition to this, the whorls are vermiculated by diaphanous zigzag lines on both the upper and lower surfaces. On the lower surface this element seems confined between the peripheral and median basal dark zones. The peristome is white. The dark bands show on the inside of the outer lip. Nuclear whorls 1.3, marked by fine lines of growth and microscopic spiral striations. The postnuclear whorls are slightly rounded and marked by rather coarse incremental lines and microscopic spiral striations. Both of these elements extend upon the base. In addition to this, the anterior half of the whorls between summit and suture and the equivalent basal portion are rather strongly malleated. The succeeding turns fall below the keeled periphery of the preceding turn, but in such a way as to form an almost continuous slope. The aperture is oval. The peristome is somewhat inbent on the posterior half, while that of the inner lip is expanded and reflected and on the parietal wall covers about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 256118, was collected by myself on a hillside on the west side of Mansalay Bay. It has 4.6 whorls, and measures: Height, 11 mm; greater diameter, 25.9 mm; lesser diameter, 21 mm.

Remarks.—This race suggests closely *Obba gallinula pagbilaoensis* Bartsch, from which it differs in being a little more lenticular; that is, a little less inflated and smaller.

OBBA LISTERI (Gray)

Martin Lister in his "Historiae sive Synopsis Methodicae Conchyliorum et Tabularum Anatomicarum," published in 1770, figures on Tabula 66 the underside of a shell that is not quite adult, which may well represent this species.

John Edward Gray, in "A List and Description of Shells not Taken Notice of by Lamarck," published in 1825 in the Annals of Philosophy (new ser., vol. 9, p. 412), has the line, "C. Listeri. List. t. 66, fa. 64, Mus. Brit.," which, translated, means that he here names the shell which Lister figured as cited above *Caracolla listeri.*

In 1841, W. J. Broderip published in the Proceedings of the Zoological Society of London (pp. 37, 38) a description of the shell and a discussion of its relationship:

Helix (Carocolla) Listeri. *Car. testâ complanatâ, umbilicatâ; anfractibus 4, lineis incrementi creberrimè striatis, ultimo maximo acuto; albido-fuscâ maculis brunneis guttatâ, et brunneo uni-fasciatâ; peritremate deorsùm flexo auriculari, albido; labii unidentati margine acuto, anticè lanceolato.*

Long. ⅝; lat. 1⅛ poll.

Hab. ad Albay insulae Luzon, truncis arborum haerens.

Legit H. Cuming in sylvis.

Mr. Cuming had named this species *Car. Gallina,* but as it is designated as *Car. Listeri* on the boards of the British Museum, and as Lister appears to have been the first who figured it, but apparently from an imperfect shell, the latter name is retained.

In colour and in the direction of the form and shape of the aperture it bears much resemblance to *Helix auriculata*, figured by Mr. Swainson (Zoological Illustrations, 1st series) from a specimen formerly in the cabinet of Mr. C. Dubois, afterwards in mine, and now in the British Museum; but in *H. auriculata* the whorls are comparatively rounded, and the body-whorl is quite round instead of having a sharp edge. *H. auriculata* is besides, in many individuals, dimpled with small depressions. These differences may be sufficient in the present state of our knowledge to constitute specific distinction; but whether they are in reality strong enough to form such a separation, may well be doubted. My present impression is, that *H. auriculata* and *H. Listeri* are identical; but I shall return to this subject when I have examined the whole of the cognate series in Mr. Cuming's collection.

Since he here cites Albay, Luzon, as the home of the species, I shall follow this dictum and consider this the habitat for the restricted typical subspecies. I am giving on Plate 88, Figure 5, photographs of three views of a typical specimen from Albay.

Obba listeri occupies a very wide range in the Philippine Archipelago, and, like most widely distributed species, it breaks up into a host of races, each of which occupies a limited zoogeographical horizon. From the Mindoro Province I have no less than nine before me, which I shall designate as subspecies. I believe that this is by no means all the races of this species that will eventually have to be recognized, for there are still a number of small islands within the area under discussion from which no Obbas are as yet known, and even the large island of Mindoro seems inadequately explored as evidenced by the few spots from which material is at hand. The unexplored reaches may therefore properly be expected to yield more members of this species.

KEY TO THE SUBSPECIES OF OBBA LISTERI

Last whorl strongly malleated.
- Axial sculpture riblike---- **sibolonensis.**
- Axial sculpture not riblike.
  - Incised spiral lines of upper surface very strong---- **campoensis.**
  - Incised spiral lines of upper surface not very strong.
    - Shell lenticular---- **halcona.**
    - Shell not lenticular.
      - Shell depressed-helicoid.
        - Shell pale and small---- **minor.**
        - Shell dark and large---- **mayabigana.**

Last whorl not strongly malleated.
- Last whorl acutely keeled.
  - Malleations absent on base---- **smithi.**
  - Malleations present on base---- **recurvata.**
- Last whorl not acutely keeled.
  - Last whorl acutely angled.
    - Malleations present on base---- **caloocana.**
    - Malleations not present on base---- **subplanulata.**

OBBA LISTERI SIBOLONENSIS, new subspecies

PLATE 88, FIGURE 2

The shell is small, depressed-helicoid, with an acute peripheral keel. The nuclear whorls 2, pale brown. The first half of the postnuclear whorls is of the same color as the nuclear turns; the rest are of buffish tinged flesh-colored ground color, streaked, spotted, and mottled with brown. An ill-defined median interrupted brown band is present on all the turns. The base is of pale buff ground color with a well-developed brown spiral band two-thirds of the distance between the periphery and the umbilicus anterior to the periphery. The depressed malleations are also brown and give to the posterior half of the underside of the last whorl a peculiar mottled appearance. The nuclear whorls are marked by rather strong incremental lines and microscopic spiral striations. The postnuclear whorls are strongly keeled at the periphery and the succeeding turns falling below the keel allow this to show as a slender band at the suture. They are marked by strong riblike axial incremental elements and are heavily malleated on the anterior two-thirds between the summit and the suture. In addition to this, fine microscopic spiral striations are present on the spire and also a still finer network of crisscross striations. The basal surface is marked by the continuations of the axial riblike elements and rather strong malleations, which extend from the periphery almost to the umbilical edge. In addition to this, rather strong spiral striations are present, much stronger than those on the upper surface and also the crisscross finer sculpture referred to above. Aperture broadly oval; peristome thickened and reflected, covering one-third of the umbilicus at the parietal wall.

Type.—The type, U.S.N.M. No. 382924, and five topotypes, U.S. N.M. No. 382925, were collected by C. Canonizado on Sibolon Island off southeastern Mindoro. The type has 4.5 whorls, and measures: Height, 11 mm; greater diameter, 24.7 mm; lesser diameter, 20.3 mm.

Remarks.—The other five specimens yield the following measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.5	9.3	22.7	19.4
4.5	10.0	23.1	20.0
4.6	10.8	22.7	19.0
4.6	10.9	24.8	20.7
4.5	10.9	25.3	21.2

This subspecies can at once be distinguished from all the other members of the Province by the riblike axial sculpture.

OBBA LISTERI CAMPOENSIS, new subspecies

PLATE 88, FIGURE 4

Shell helicoid, broadly conic with an acute peripheral keel. The two nuclear whorls are uniform pale brown and marked by fine incremental lines. The remaining whorls are of brown ground color, which becomes intensified on the succeeding whorls. This ground color is broken up by areas of soiled flesh color, pale yellow, or buff, and in spots almost pale orange, which blotch, streak, and fulgurate the upper surface. In addition to this, the postnuclear whorls are marked by a rather broad spiral brown band, the basal portion of which marks the median portion of the turns between the summit and the periphery. The base is of yellowish buff ground color. There is a broad, more or less interrupted and irregular band of bright brown about one-third of the distance between the periphery and the umbilicus. The malleations between this and the periphery and also those between the periphery and the umbilicus are of a paler shade of brown. Peristome flesh-colored, tinged with brown. Interior of outer lip brown with a purplish tinge, darker at the bands described for the outside. The postnuclear whorls are very strongly malleated; the malleations extend over the entire upper surface, while on the base they become weaker toward the umbilicus. In addition to the strong malleations, the whorls are marked by irregular incremental lines and very strong incised spiral lines, which are best shown on the next to the last turn. On the base they are best expressed in the umbilicus and adjacent area, being decidedly obscured toward the periphery by the malleations. The aperture is ovate; the peristome is rather strongly thickened and reflected, covering about one-third of the umbilicus at the parietal wall. The inner lip bears a slender tooth on its middle.

Type.—The type, U.S.N.M. No. 382926, was collected by C. Canonizado, of the Philippine Bureau of Science, at Maestre de Campo Island off east-central Mindoro. It has 4.5 whorls, and measures: Height, 14.7 mm; greater diameter, 31.3 mm.; lesser diameter, 25.8 mm.

Remarks.—Four additional specimens from the same island yield the following measurements:

U.S.N.M. No.	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
382927 (topotypes)	5.0	13.8	30.3	25.0
	4.8	12.9	29.8	24.9
	4.8	13.3	31.4	25.9
382928	4.7	14.0	29.8	24.3

This subspecies resembles most nearly *Obba listeri mayabigana* from Mindoro, from which it differs in being much more elevated and in having the malleations on the base extending far nearer the umbilicus. *O. l. mayabigana* also has a decided, fine, crisscross sculpture, which appears to be absent in the present race.

OBBA LISTERI HALCONA, new subspecies

PLATE 88, FIGURE 3

The shell is decidedly depressed-lenticular with a very acute peripheral keel and a broad, open umbilicus. The nuclear whorls are flesh-colored; the postnuclear whorls are decidedly mottled, spotted, and streaked with flesh color, pale brown, darker brown, orange, and variations of these elements. A supramedian brown band encircles the whorls on the upper surface. The base is rather inflated, yellowish buff with a broad bright chestnut-colored band, which is a little posterior to the middle between the periphery and the umbilicus. The peristome is white with a buffish tinge. The inside of the outer lip is very pale brown. The first postnuclear whorl is marked by incremental lines and rather weak spiral striations; the remaining turns are malleated, a little less strongly near the summit than the periphery. They are also marked by strong incremental lines and rather feebly incised spiral lines. The base slopes from near the umbilicus to the acute periphery and is malleated to the edge of the umbilicus, the malleations being stronger toward the periphery. It is also marked by incremental lines and fine spiral striations. The latter are best expressed about the umbilical area. Aperture somewhat polygonal, very broad, with a decided dent at the peripheral angle. Peristome thickened and reflected, covering about one-fourth of the umbilicus. The inner lip with a conspicuous tooth on its middle.

Type.—The type, U.S.N.M. No. 382929, was collected by Col. Edgar A. Mearns on Mount Halcon during his expedition to that mountain in Mindoro. It has 4 whorls, and measures: Height, 9.9 mm; greater diameter, 27.4 mm; lesser diameter, 22.8 mm.

Remarks.—There are two additional fragments obtained on the same expedition in our collection. They are registered as U.S.N.M. Nos. 256542 and 256503.

This subspecies differs from all the other members of the region by its depressed-lenticular form and the width of its umbilicus.

OBBA LISTERI MINOR (Möllendorff)

PLATE 89, FIGURE 2

1898. *Obbina listeri minor* MÖLLENDORFF, nom. nud., Abh. Naturf. Ges. Görlitz, vol. 22, p. 86, in part.

1905. *Obbina listeri minor* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, p. 22, in part, pl. 6, fig. 2.

While the two references cited above report this subspecies from Mindoro, Tablas, Romblon, and Sibuyan Islands, I wish now to restrict it to Mindoro. Good and sufficient characters are to be found in the abundant material before me from the other islands to warrant their subspecific separation, which will be done at some future time.

The shell is depressed-helicoid with an acute peripheral keel and moderately broad umbilicus. The nuclear whorls are flesh-colored with a buffish tinge. The postnuclear turns are of flesh-colored ground color, mottled, streaked, and variegated with various shades of chestnut-brown. The base is flesh-colored and marked by a broad interrupted spiral band of brown about one-third of the distance between the umbilicus and the periphery anterior to the periphery. In addition to this, the malleations of the base are marked by a weak wash of brown. The peristome is white and the inside of the outer lip dusky brown with the darker band of darker color showing through as a darker zone. The nuclear whorls are marked by fine incremental lines and fine spiral striations, while the postnuclear turns are also marked by rather strong incremental lines and moderately strong incised spiral lines. They are also strongly malleated, the malleations extending almost to the summit of the turns. In addition to this, the surface is marked by very fine crisscross sculpture, which is best expressed immediately behind the aperture. The base is moderately convex, marked by moderately strong incremental lines and moderately strong spiral striations, which are best expressed in the umbilical area. In addition to this, it is covered with very strong malleations, which extend from the periphery to the edge of the umbilicus. The aperture is oval; the peristome is broadly expanded and reflected, covering about one-third of the umbilicus at the parietal wall. The inner lip bears a broad tooth on its middle.

The present subspecies is represented in our collection by two specimens from the Cuming collection, U.S.N.M. No. 116910. These come from Mindoro without specific locality. They give the following measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.7	10. 8	28. 0	23. 2
4.7	12. 2	27. 6	13. 0

The present subspecies belongs to the strongly sculptured group. It resembles *O. l. campoensis*, from which it can at once be distinguished by its much smaller size and paler coloration.

OBBA LISTERI MAYABIGANA, new subspecies

PLATE 89, FIGURE 1

The shell is rather large, depressed-helicoid, and acutely keeled at the periphery. The nuclear whorls are of soiled flesh-color. The ground color of the rest of the shell is also of this tint, but tinged with buff. In addition to this, the upper surface of the whorls is variegated and blotched and spotted with brown, among which the ground color appears more or less in the shape of fulgurations. There is a supramedian interrupted line of brown. The base is pale yellow with an interrupted band of brown about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The malleations between this brown band and the periphery are of a paler shade of brown. The peristome is soiled white, and the interior of the aperture is brown with a purplish tinge. The nuclear whorls are marked with fine incremental lines and microscopic spiral striations. The postnuclear whorls are strongly malleated, the malleations extending to the summit. In addition to this, they are marked by strong incremental lines and fine crisscross sculpture, which is best shown behind the aperture of the last turn. The base is marked by the continuation of the incremental lines and rather strong malleations, which extend about halfway between the periphery and the umbilicus, the umbilical portion being marked by incised spiral lines. The aperture is irregularly oval; the peristome is expanded and reflected, covering about one-third the umbilicus. The inner lip bears a conspicuous tooth.

Type.—The type, U.S.N.M. No. 322930, was collected by Pedro de Mesa at Mayabig, Baco, Mindoro. It has 4.9 whorls, and measures: Height, 13 mm; greater diameter, 33.3 mm; lesser diameter, 26.4 mm.

Remarks.—Thirteen topotypes, U.S.N.M. No. 382931, yield the following measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	4. 8	12. 6	29. 9	25. 3
	5. 0	13. 2	33. 5	27. 3
	4. 8	15. 2	31. 6	25. 6
	4. 8	13. 8	29. 7	24. 6
	5. 0	14. 5	32. 1	26. 0
	4. 9	13. 6	31. 8	25. 2
	5. 0	15. 8	32. 0	26. 1
	4. 8	13. 4	30. 0	24. 3
	5. 0	15. 2	31. 5	25. 8
	4. 9	13. 3	32. 1	26. 0
	4. 9	13. 3	30. 8	25. 5
	5. 0	16. 1	33. 7	26. 4
	5. 1	13. 5	33. 1	26. 5
Average	4. 923	14. 115	31. 677	25. 738
Greatest	5. 1	16. 1	33. 7	27. 3
Least	4. 8	12. 6	29. 7	24. 3

This subspecies recalls *O. l. campoensis*, but it is much less elevated and differs in having the malleations on the base approaching the umbilicus to a much lesser degree.

OBBA LISTERI SMITHI, new subspecies

PLATE 89, FIGURE 5

The shell is large, lenticular, and acutely keeled at the periphery with a narrow umbilicus. The coloration of the unique type, which is a dead specimen, is problematical. It is flesh-colored with an interrupted median band of blotches on each turn. There is also a narrow interrupted band on the basal surface, about one-third of the distance between the periphery and the umbilicus. The nuclear whorls are well rounded, marked by fine incremental lines and microscopic spiral striations. The postnuclear whorls are rather flattened on the upper surface and decidedly keeled, the succeeding turns falling below the keel. They are marked by retractively curved incremental lines and spiral striations, which increase in size on the turns, and on the last whorl behind the aperture become exceedingly strongly incised. What there is of malleation on the upper surface is very weakly expressed. The base is slightly convex, marked by incremental lines and spiral striations, which are a little stronger toward the periphery than toward the umbilicus, and are most strongly developed immediately behind the aperture. The aperture is oval, with the perisome expanded, thickened, and reflected to cover about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 256413, was collected by the writer at Port Tilig, Lubang Island. It has 4.5 whorls, and measures: Height, 12.5 mm; greater diameter, 35.3 mm; lesser diameter, 28.2 mm.

Remarks.—This is one of the most aberrant members of the *listeri* complex. Its exceedingly strong incised spiral lines behind the aperture separate it from all the other members of the group.

I take pleasure in naming this subspecies for Dr. Hugh M. Smith, who was deputy commissioner of the United States Bureau of Fisheries and director of the United States Bureau of Fisheries *Albatross* Expedition to the Philippine Islands.

OBBA LISTERI RECURVATA (Möllendorff)

PLATE 89, FIGURES 3, 4

1896. *Obba listeri* var. *scalaris* ELERA, nom. nud., Catalogo sistematico de toda la fauna Filipinas, vol. 3, p. 522.

1898. *Obbina listeri recurvata* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 86.

1898. *Obbina listeri recurvata* var. *subscalaris* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 86.

1905. *Obbina listeri recurvata* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, pp. 22–23, pl. 6, figs. 3, 4.

The shell is depressed-helicoid, almost lenticular. The early whorls are flesh-colored, while the succeeding turns have the ground color flesh-colored with a buffish tinge. The postnuclear whorls are, in addition to this, blotched, spotted, and streaked with chestnut-brown, the spotting forming more or less of an interrupted median band. The base also has an interrupted spiral band of dots about two-fifths of the distance between the periphery and the umbilicus. The malleations on the basal side are also darker tinged. The peristome is flesh-colored with a dusky tinge, while the outer lip is a little darker with the darker streaks of the outside showing through conspicuously. In this subspecies we have an enormous variation both as to size and the curving of the peripheral keel. In some individuals the succeeding turns fall far below the peripheral keel and produce a decidedly scalariform effect. The peripheral keel may jut out in a perfectly straight fashion or it may be upturned at the edge. All in all, there is a greater range of variation here than I have observed anywhere else in the genus *Obba*. The nuclear sculpture consists of fine incremental lines and microscopic spiral striations, while the postnuclear whorls have the basal half malleated and the whole surface marked by rather strong incremental lines and slender incised spiral lines. In addition to this, there is a conspicuous crisscross sculpture best developed on the last portion of the last whorl. The base is somewhat inflated with rather feeble incremental lines and moderately well-incised spiral striations. This also has malleations between the brown band and the periphery, and is likewise provided with a strong crisscross sculpture. The aperture is oval with the peristome quite strongly expanded and reflected, covering about one-third of the umbilicus. All our specimens are from the Island of

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	[1] 4. 8	[1] 8. 6	[1] 17. 7	[1] 14. 8
	4. 8	9. 6	22. 6	18. 1
	4. 9	11. 9	25. 4	20. 5
	4. 8	8. 7	22. 0	18. 5
	4. 8	10. 5	24. 6	19. 8
	5. 0	11. 8	28. 7	22. 6
	4. 9	11. 6	24. 1	19. 1
	5. 0	11. 0	24. 5	19. 6
	4. 8	10. 0	22. 0	18. 2
	5. 1	12. 0	24. 6	20. 3
	4. 8	10. 6	25. 6	19. 8
	4. 7	8. 6	20. 1	16. 3
	4. 9	8. 4	19. 8	16. 1
Average	4. 87	10. 25	23. 207	18. 746
Greatest	5. 1	12. 0	28. 7	22. 6
Least	4. 7	8. 4	17. 7	14. 8

[1] Type.

Lubang. Six are recorded as U.S.N.M. No. 195646, of which the specimen figured has 5 whorls, and measures: Height, 11 mm; greater diameter, 24.5 mm; lesser diameter, 19.6 mm. The scalariform specimen that we have figured has 4.9 whorls, and measures: Height, 8.4 mm; greater diameter, 19.8 mm; lesser diameter, 16.1 mm. The remaining 12 specimens yield measurements as given in the table on the opposite page.

This subspecies, owing to its great variation in size and its peculiar scalariform tendencies, of which indications are shown even in specimens that do not have an elevated or scalariform spire, is readily differentiated from all the others. The scalariform variations were noted by von Möllendorff as cited, under the name of *subscalaris*, and Elera probably had the same in mind when he used the name *scalaris*.

OBBA LISTERI CALOOCANA, new subspecies

PLATE 90, FIGURE 1

The shell is small, depressed-helicoid, almost lenticular, with an acute angle at the periphery. The nuclear whorls are pale brown; the succeeding whorls flesh-colored, spotted with blotches and streaks of brown, of which one series forms a median interrupted band and a second less conspicuous spiral zone between this and the summit. The base is pale yellowish with a conspicuous interrupted spiral band about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The early postnuclear whorls are acutely keeled, and the summit of the succeeding turns falls immediately below the periphery. They are marked by moderately strong, retractively curved incremental lines and rather conspicuous incised spiral lines. Likewise are they marked by inconspicuous malleations on the anterior half. These malleations are not present on the last half of the last turn, but they are present immediately below the periphery on the base, although here also but weakly expressed. The fine crisscross sculpture is present on both spire and base, and is best shown immediately behind the aperture. The base is marked by the continuation of the axial riblets and moderately strong incised spiral lines. The aperture is oval; the peristome is strong, thickened, and reflected, covering about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 382934, comes from Caloocan, Mansalay, Mindoro. It has 4.8 whorls, and measures: Height, 11.9 mm; greater diameter, 27.7 mm; lesser diameter, 12.3 mm.

Remarks.—This subspecies resembles most nearly *Obba listeri subplanulata* Möllendorff from Ambil Island. Like that it has a decided peripheral angle, but not the usual extremely acute keel present in *Obba listeri*. It has the conspicuous colored banding of

O. l. subplanulata both on the upper and lower surfaces, which suggests *Obba mesai*, but it differs from *O. l. subplanulata* in having the whorls more inflated, in having a broader umbilicus, and in having malleations on both the upper and lower surfaces.

OBBA LISTERI SUBPLANULATA (Möllendorff)

PLATE 90, FIGURE 2

1898. *Obbina listeri subplanulata* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 86.

1905. *Obbina listeri subplanulata* MÖLLENDORFF, KOBELT, and WINTER, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, p. 23, pl. 6, fig. 7.

The shell is small, not acutely keeled at the periphery, but rather strongly angulated. The nuclear whorls are pale brown; the postnuclear whorls are of pale buff color with a series of rather large, irregular, chestnut-brown spots midway between the summit and the periphery of the turns, and a less conspicuous band halfway between this and the summit. There are other lesser blotches also present on the upper surface. The base is pale yellow, marked with a broad interrupted band of brown spots about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The peristome is white, while the interior of the outer lip is pale brown with the external bands showing darker through the substance of the shell. The nuclear whorls are marked by fine incremental lines and microscopic spiral striations. In the postnuclear whorls the incremental lines and spiral striations become stronger except on the last whorl, where the latter element somewhat weakens and where the conspicuous crisscross sculpture presents itself. The incremental lines extend on the lower surface, which is also marked by fine spiral striations and crisscross sculpture. The aperture is rather broadly ovate with the peristome expanded and reflected to cover one-third of the umbilicus. There is a conspicuous broad fold on the inside of the inner lip.

The specimen described and figured, U.S.N.M. No. 382933, comes from the Quadras collection and was collected on Ambil Island, the type locality for this subspecies. It has 4.7 whorls, and measures: Height, 11.5 mm; greater diameter, 28.1 mm; lesser diameter, 23.1 mm.

This subspecies strongly suggests the *Obba mesai* group in the conspicuous spotting of the interrupted spiral bands of the base. It differs from the members of this group by the much more strongly angulated periphery. In this respect it is much more closely allied to *Obba listeri*. It is nearest related to *O. l. caloocana* from Caloocan, from which it can at once be distinguished by the absence of the malleations on the base.

OBBA SUBHORIZONTALIS RADCLIFFEI, new subspecies

PLATE 90, FIGURE 3

While collecting on a hill bordering the shore of Mansalay Bay, Mindoro, I found an *Obba* that resembles *O. subhorizontalis* in such a remarkable way that had it come from the island of Sibuyan, the type locality for the typical race, I would unhesitatingly have referred it here. The separation of locality has caused me to subject it to the most critical examination, with the result that I find that the base of this shell is a little less rounded than that of the typical subspecies, and the umbilicus is a little wider. There are also spiral striations present on the anterior half of the base and in the umbilicus, which I have not been able to observe in the typical race. I believe that these are good and sufficient characters to consider this distinct from *Obba subhorizontalis subhorizontalis*.

Type.—The type, U.S.N.M. No. 256501, has 4.3 whorls, and measures: Height, 12 mm; greater diameter, 27.8 mm; lesser diameter, 22.6 mm.

Remarks.—I take pleasure in naming this race for Dr. Lewis Radcliffe, deputy commissioner of the United States Bureau of Fisheries, who was a member of our scientific staff during the United States Bureau of Fisheries *Albatross* Expedition to the Philippine Islands.

OBBA SARCOCHROA ILOGANA, new subspecies

PLATE 90, FIGURE 5

The shell is broadly conic and has a decided peripheral angle. The umbilicus is half closed by the reflected inner lip. The general ground color is soiled flesh-color. On the upper surface there is a slender median brown thread, which extends from the end of the nuclear whorls to the last turn; on the latter it is absent. In addition to the median brown band, the first 2.3 postnuclear whorls are marked with a second less conspicuous spiral zone a little below the summit. The first 1.5 postnuclear whorls are also much darker than the rest. In addition to the spiral bands, the whorls are more or less mottled with scattered faint blotches and axial streaks of brown on the upper surface. The base is uniformly soiled flesh-color, while the peristome is pale brown tinged with buff. The nuclear whorls are marked by faint incremental lines and spiral striations. On the postnuclear whorls both of these elements become a little intensified except on the last whorl, where enfeebling again takes place, at least in the spiral striations. The basal third of the penultimate whorls also shows an irregular scratchy crisscross sculpture, which gives to that portion of the whorl a somewhat malleated appearance. The base is slightly rounded and marked by incremental lines and rather regularly spaced,

well-incised, wavy, spiral striations. The aperture is oval with the peristome very strongly developed, expanded, thickened, and reflected, covering half of the umbilicus.

The type and eight specimens were collected by Pedro de Mesa at Tara, Abra de Ilog, northern Mindoro, Philippine Islands.

Type.—The type, U.S.N.M. No. 382700, has 4.9 whorls, and measures: Altitude 17.7 mm; greater diameter, 28.9 mm; lesser diameter, 23.3 mm.

Remarks.—The other eight specimens yield the following measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	4.9	18.6	31.0	24.2
	[1]4.9	[1]17.7	[1]28.9	[1]23.3
	5.0	17.3	30.1	23.3
	5.0	15.6	28.5	22.8
	5.0	17.1	28.7	23.4
	4.8	14.9	28.3	22.5
	5.2	16.0	28.1	23.1
	4.8	18.0	31.0	25.0
	5.1	14.1	28.3	22.0
Average	4.967	16.59	29.21	23.18
Greatest	5.2	18.6	31.0	25.0
Least	4.8	14.1	28.1	22.0

[1] Type.

The present race can at once be distinguished from *Obba sarcochroa sarcochroa* Möllendorff by the smaller size and much flatter shape.

OBBA MESAI, new species

Shell lenticular, umbilicated, pale buff or flesh-colored, with the upper surface marbled and variegated with brown; the lower surface with an interrupted band of brown at some little distance anterior to the periphery. Peristome white or pale buff. Basal lip provided with a poorly developed median tooth. Periphery of last whorl obsoletely angled. The upper surface behind aperture is marked, in addition to incremental and fine spiral lines, by two sets of very regular microscopic incised lines, which are at right angles to each other and which cut the lines of growth obliquely. I shall call these crisscross lines in the key to the subspecies.

This species differs from *Obba listeri* in having the periphery scarcely at all angulated, a character usually very pronounced in that species. In the inflation and rounding of the periphery it resembles *Obba planulata* more closely, from which the conspicuous interrupted basal band will at once distinguish it.

The races recognized here are from the islands of Lubang, Ilin, and probably southern Mindoro.

The species is named for Pedro de Mesa, whose fine sending of the typical races stimulated the present revision.

KEY TO SUBSPECIES OF OBBA MESAI

Crisscross lines rather strongly developed on upper surface.
  Crisscross sculpture on lower surface strong ..... sablayana.
  Crisscross sculpture on lower surface obsolete ..... richi.
Crisscross lines feebly developed on upper surface.
  Spiral striations strong ..... mesai.
  Spiral striations obsolete ..... johnsoni.

OBBA MESAI SABLAYANA, new subspecies

PLATE 91, FIGURE 3

The early whorls are of flesh-colored ground color; the later ones are straw-colored, as is also the base. The interrupted dark zones and mottlings occupy the major portion of the upper surface of the shell, and are dark chestnut-brown; brighter on the early turns. The peristome is soiled pale buff. Crisscross sculpture strongly developed on both the upper and lower surfaces. The spiral striations are almost obsolete on the upper surface of the last half of the last whorl and only feebly expressed on the lower surface.

Type.—The type, U.S.N.M. No. 382697, was collected on the United States Bureau of Fisheries *Albatross* Expedition on Sablayan River, southern Mindoro. It has 5 whorls, and measures: Height, 14.9 mm; greater diameter, 32.7 mm; lesser diameter, 25.1 mm.

Remarks.—Ten topotypes, U.S.N.M. No. 296929, yield the following measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	5. 1	12. 7	31. 1	24. 9
	5. 0	12. 2	30. 6	24. 8
	5. 0	13. 1	30. 3	23. 9
	5. 0	13. 1	33. 8	26. 0
	5. 0	13. 4	32. 4	25. 6
	5. 2	13. 0	32. 2	25. 8
	4. 9	13. 7	32. 3	25. 3
	5. 2	14. 4	30. 6	24. 4
	5. 0	13. 0	30. 9	23. 7
	5. 0	13. 4	32. 8	26. 0
Average	5. 04	13. 2	31. 7	25. 04
Greatest	5. 2	14. 4	33. 8	26. 0
Least	4. 9	12. 2	30. 3	23. 7

This subspecies belongs to the strongly crisscross sculptured group of *Obba mesai*, which character it shares with *O. m. richi*, but in *richi* the crisscross sculpture is obsolete on the base, while in the present subspecies it is strongly developed there.

OBBA MESAI RICHI, new subspecies

PLATE 91, FIGURE 1

The ground color of the early whorls is flesh-color, while that of the later turns is buff. The interrupted bands of brown and mottlings are chestnut-brown. The peristome is soiled white. The spiral striations are quite obsolete on the upper surface of the last half of the last turn, but quite strongly developed on the base.

Type.—The type, U.S.N.M. No. 382698, has 4.9 whorls, and measures: Height, 13.2 mm; greater diameter, 29 mm; lesser diameter, 22 mm.

In the collection of the United States National Museum are two lots of two each of shells of a race of *Obba mesai* about whose definite locality I am in doubt. One of these, U.S.N.M. No. 21043, two specimens collected by the United States Exploring Expedition, bears the label "P. I." The other, U.S.N.M. No. 103967, collected by Rich, bears the label "Luzon, Philippines." One of these is now reentered as U.S.N.M. No. 382698, the type.

Remarks.—The exploring expedition sent out a party from Manila to Laguna de Bay, where it divided, one part visiting the region about Los Baños, including Mount Maquiling, the other pushing toward Banahao, reaching at least Majayjay and Pagsanjan River. Rich, Dana, and Brackenridge were in the Los Baños party.

Since I have seen no specimens from Luzon that appear to belong to the *Obba mesai* complex, I doubt if these were obtained here. The general distribution of the species makes it much more likely that these shells were obtained at the south end of Mindoro, which was also visited by the expedition, and we assume that this was the case.

The topotype, U.S.N.M. No. 103967, has 5 whorls, and measures: Height, 13.8 mm; greater diameter, 28.2 mm; lesser diameter, 22.2 mm. The adult specimen marked "Exploring Expedition collection," U.S.N.M. No. 21043, has 5 whorls, and measures: Height, 15.3 mm; greater diameter, 30.2 mm; lesser diameter, 23 mm.

The present subspecies has the strong crisscross sculpture of *Obba mesai sablayana* on the upper surface of the last half of the last turn. It is distinguished from it by practically lacking this element on the basal surface.

OBBA MESAI MESAI, new subspecies

PLATE 91, FIGURE 2

The typical race when alive is of pale buff ground color on the early turns, deepening on the later and base. In dead specimens the ground color is flesh-color. The dark interrupted bands and mottlings are dark chestnut-brown, the peristome being buffish flesh-colored. The crisscross markings are very fine, almost obsolete,

showing best immediately behind the peristome on the upper surface. The spiral striations are conspicuous—more so on the basal portion of the last turn than on its upper surface.

Type.—The type, U.S.N.M. No. 382694, has 5.1 whorls, and measures: Height, 13.3 mm; greater diameter, 29.7 mm; lesser diameter, 22.9 mm. It was collected by Pedro de Mesa on Lubang Island.

Remarks.—Twenty-five topotypes, U.S.N.M. No. 382695, yield the following additional measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	5.0	14.8	30.2	22.9
	4.9	16.6	30.8	23.3
	5.0	14.4	29.7	23.7
	5.1	12.8	26.6	19.1
	5.1	15.9	32.6	19.3
	5.1	14.4	29.0	23.0
	5.0	12.4	27.6	16.2
	5.1	13.6	29.0	16.3
	5.1	12.8	28.8	22.3
	5.0	12.6	30.9	22.5
	5.0	13.9	27.6	21.0
	5.2	12.1	28.4	22.0
	5.0	14.4	33.1	25.4
	5.0	14.2	29.0	22.8
	5.0	14.3	30.8	22.7
	4.9	13.6	28.8	22.5
	5.0	13.4	28.6	22.5
	5.0	16.8	31.7	24.5
	5.1	14.3	29.4	22.6
	4.9	13.5	30.3	23.6
	5.0	13.4	28.3	22.0
	5.0	13.4	29.0	22.4
	5.0	14.7	30.8	23.4
	5.0	13.5	29.9	22.8
	5.1	15.9	33.0	24.8
Average	5.02	14.07	29.76	22.14
Greatest	5.2	16.8	33.1	25.4
Least	4.9	12.1	26.6	16.2

This subspecies is distinguished from the other three here recognized by its feeble crisscross sculpture, which it has in common with *Obba mesai johnsoni*. From *O. m. johnsoni* it is easily distinguished by its much stronger basal spiral sculpture.

OBBA MESAI JOHNSONI, new subspecies

PLATE 92, FIGURE 4

The ground color is flesh-color with a buffish tinge. The interrupted brown bands and mottlings are bright chestnut-colored, being a little paler on the early than on the later turns. The peristome is flesh-colored with a buffish tinge. The crisscross markings are almost

obsolete, being apparent only on the upper surface behind the peristome. The spiral sculpture is poorly developed on both upper and lower surface, but is a little stronger on the lower than the upper.

Type.—The type, U.S.N.M. No. 382699, comes from Ilin Island, south of Mindoro. It has 5 whorls, and measures: Height, 13 mm; greater diameter, 29.2 mm; lesser diameter, 22.5 mm.

Remarks.—This subspecies, like *Obba mesai mesai*, has the crisscross sculpture poorly developed. It is distinguished from *O. m. mesai* by having the spiral sculpture much less strongly developed.

I take pleasure in naming this for Rear Admiral Marbury Johnson, who was in command of the *Albatross* during the first half of her cruise in Philippine waters.

OBBA MARMORATA ILINENSIS Bartsch

PLATE 90, FIGURE 4

1932. *Obba marmorata ilinensis* BARTSCH, U. S. Nat. Mus. Bull. 100, vol. 6, pt. 7, p. 341, pl. 86, fig. 3.

This is the smallest race of this species. Its distribution is rather interesting, and it is quite possible that careful collecting in Mindoro will show races of it eventually. It is a pale race, the shell being rather broadly conic. The periphery of the last whorl is rather rounded than angulated, but an obsolete indication of angulation is present. The incremental lines on the upper and lower surface are not so rough as in the other races, and the wrinkling of both surfaces resembles scratches more than the strong wrinkles of some of its other subspecies. The aperture is oval, moderately broad, and the peristome is strongly expanded and reflected on the outer and basal lips. The umbilicus is narrow and half covered by the reflection of the inner lip.

The unique type, U.S.N.M. No. 313001, was donated by Walter F. Webb. It comes from Ilin Island, which lies a short distance off the south coast of Mindoro. It has 4.8 whorls, and measures: Height, 13 mm; greater diameter, 14.2 mm; lesser diameter, 19 mm.

OBBA PLANULATA (Lamarck)

PLATE 92, FIGURES 1, 5

Obba planulata (Lamarck) was described in part 2, volume 6, page 73, of the "Histoire Naturelle des Animaux sans Vertebres," in 1822. No locality is cited as a habitat. In 1838, Deshayes, in his edition of the same work, cites Férussac's "Prodrome," page 69, and Férussac's "Histoire Naturelle des Mollusques," where on pages 48 and 49 he discusses *Helix planulata* Lamarck and where he gives three figures

of it on Plate 73A, Figure 3. He cites here Philippine Islands as its home.

These figures represent the giant form. A facsimile specimen is represented in our Lea collection as U.S.N.M. No. 105990. I am copying Férussac's figures (pl. 92, fig. 1) and giving also similar photographs of our shell (pl. 92, fig. 5), which, unfortunately, is also without definite locality. The shell figured on Plate 9 and described by Swainson in his "Zoological Illustrations" in 1820 as *Helix auriculata* appears to belong to the typical race and was most likely received from the same source from which Lamarck obtained his specimen. Swainson states that he received it from Ch. Dubois, Esq.

I am unable to say anything about the position of *Helix papilionacea* Valenciennes, as I have not access to the work in which it is published, but follow Pfeiffer in placing it here.

Mindoro presents an interesting field for the study of zoogeographic races of *Obba*. In the case of the present species we have no less than six races represented in the material before us. One of these is from the central north coast, *Obba planulata varaderoana;* the second, *O. p. paluana*, from the Paluan Bay region. This seems to extend across the northwestern peninsula to Abra de Ilog, at least so a poorly preserved specimen in our collection from that locality would indicate. The third, *O. p. bongabona*, comes from Bongabon on the east coast. The fourth, *O. p. mansalayana*, comes from the Mansalay Bay region. The fifth, *O. p. mangarina*, comes from the southern end at Mangarin, and the sixth, *O. p. cagurayana*, comes from near-by Caguray.

In addition to these races on the island of Mindoro proper, we have material also from some of the small islands adjacent to Mindoro. One, *O. p. medioensis*, I collected on Medio Island, a small isle in Galera Bay off northeastern Mindoro. Another race, *O. p. verdensis*, comes from Verde Island north off Varadero Bay, Mindoro. A third, *O. p. salcedoi*, comes from Ilin Island off southern Mindoro, and a fourth, *O. p. lubangensis*, I collected on Gunting Mountain near Looc, Lubang Island.

KEY TO THE SUBSPECIES OF OBBA PLANULATA IN THE MINDORO PROVINCE

Last whorl malleated.
- Malleations on upper surface extending to the peristome.
  - Malleation exceedingly rough ..... **lubangensis.**
  - Malleation not exceedingly rough.
    - Greater diameter more than 30 mm ..... **varaderoana.**
    - Greater diameter less than 28 mm ..... **salcedoi.**
- Malleations on upper surface not extending to the peristome.
  - Periphery of last whorl acutely angulated ..... **bongabona.**
  - Periphery of last whorl not acutely angulated ..... **paluana.**

Last whorl not malleated.
Spiral sculpture on the upper surface of last whorl strong.
Interrupted spiral brown band conspicuous on base---- **mansalayana.**
Interrupted spiral brown band not conspicuous on base.
Shell depressed-helicoid---------- **medioensis.**
Shell not depressed-helicoid.
Shell conic---------- **mangarina.**
Spiral sculpture on upper surface of last whorl not strong, but feeble.
Shell depressed-helicoid---------- **verdensis.**
Shell not depressed-helicoid.
Shell conic---------- **cagurayana.**

OBBA PLANULATA LUBANGENSIS, new subspecies

PLATE 91, FIGURE 5

The shell is depressed-helicoid. The nuclear whorls are flesh-color, which is also the ground color of the postnuclear turns, but these are spotted, streaked, and vermiculated with brown, there being a concentration of these markings midway between the summit and the periphery to form an interrupted spiral band. A second band of this type is present on the base about one-third of the distance between the periphery and the umbilicus. The base is also finely spotted with brown markings. The nuclear whorls are about 1.4, and are marked by fine incremental lines. The first one and one-half postnuclear whorls are a little more finely sculptured than the succeeding turns, which are decidedly rough and strongly malleated from the summit to the suture, the malleations extending to the peristome on the last turn. The under surface also is malleated and rough. The aperture is oval; the peristome is strongly thickened, reflected, and covers about one-third of the umbilicus at the parietal wall. There is a broad, median tooth on the inside of the basal lip.

Type.—The type, U.S.N.M. No. 382702, was collected by myself on the top of Gunting Mountain, Lubang Island. It has 5 whorls, and measures: Height, 14.1 mm; greater diameter, 30.2 mm; lesser diameter, 23.5 mm.

Remarks.—Seven topotypes, U.S.N.M. No. 256527, furnish the following additional measurements:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
5.1	15. 7	32. 3	25. 3
5.3	15. 6	31. 2	24. 9
5.2	14. 4	29. 6	23. 9
5.1	14. 0	29. 9	23. 9
5.2	14. 2	30. 6	23. 9
5.1	14. 8	30. 2	23. 0
5.0	14. 5	32. 3	24. 6

The present species is most nearly related to *Obba planulata varaderoana*, from which it differs by its much rougher sculpture and its somewhat smaller size.

OBBA PLANULATA VARADEROANA, new subspecies

PLATE 92, FIGURE 4

The shell is large, depressed-helicoid, almost lenticular, with a conspicuous carina at the periphery. There is an indication of a median color band consisting of a series of spots, which disappear upon the last half turn. The rest of the upper surface is blotched and spotted and streaked with brown; the pattern is best understood by consulting our figure of the upper surface of the shell. The last third of a turn is darker than the rest and the colored elements more fused. The base is soiled flesh-color, with the outer third vermiculated with pale brown, the inner border of which terminates in a more or less conspicuous band. The peristome is buff with a dusky wash. The postnuclear whorls are malleated on the anterior half, the malleations extending to the peristome on the last whorl on both the upper and lower surface. The whorls are also marked by incised spiral lines, which are stronger on the early postnuclear whorls and the base than on the upper surface of the last whorl. The incremental lines are rather coarse. The aperture is large and rather broad; the peristome is thickened and reflected, and almost half covers the umbilicus. The tooth on the inner lip is strong.

Type.—The type, U.S.N.M. No. 382703, and eight adult specimens, U.S.N.M. No. 256424, were collected by me at Varadero, northeastern Mindoro. The type has 5 whorls, and measures: Height, 15.2 mm; greater diameter, 33 mm; lesser diameter, 27.6 mm.

Remarks.—The nine specimens yield the following comparative measurements:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	[1] 5. 0	[1] 15. 2	[1] 33. 0	[1] 27. 6
	5. 1	14. 5	31. 1	25. 9
	5. 3	15. 3	33. 9	26. 7
	5. 1	14. 2	32. 0	25. 8
	5. 1	15. 6	32. 5	25. 5
	5. 2	15. 6	31. 4	25. 0
	5. 2	15. 1	30. 6	25. 5
	5. 3	14. 8	30. 8	24. 4
	5. 3	16. 3	30. 7	24. 8
Average	5. 177	15. 177	31. 77	25. 69
Greatest	5. 3	16. 3	33. 9	27. 6
Least	5. 0	14. 2	30. 6	24. 4

[1] Type.

The present species belongs to the group which has the malleations on the last whorl extending to the peristome. The only other known member with this character in the general region is *Obba planulata salcedoi*, a much smaller race from Ilin Island.

OBBA PLANULATA SALCEDOI, new subspecies

PLATE 92, FIGURE 3

The shell is lenticular, the last whorl rather acutely angulated at the periphery. The nuclear whorls and the ground color of the postnuclear whorls are flesh-colored. The postnuclear whorls are marked by streaks and blotches of pale brown, and the median spiral band of brown, which extends almost to the peristome. The base is of flesh-colored ground color; the posterior half has the pits of the malleations brown; the peristome is soiled buff and the interior of the outer lip pale brown. The nuclear whorls are marked by fine incremental lines and microscopic spiral striations. The early postnuclear whorls are acutely angulated, the succeeding turns falling below the angle. The first and second postnuclear whorls are malleated on the anterior half; the last one is strongly malleated almost over its entire surface, only the portion immediately below the summit being free of these strong hammer marks. The base is moderately rounded and also malleated on its posterior half. In addition to the malleations, the postnuclear whorls are marked by not strong but irregular incremental lines and very fine spiral striations, likewise fine crisscross lines, which cut the incremental lines and spiral sculpture obliquely. These crisscross lines are strongly marked on the upper surface of the last whorl. The aperture is rather small, broadly oval; the peristome is reflected and thickened and covers about one-third of the umbilicus.

Type.—The type, U.S.N.M. No. 382891, comes from Ilin Island, south of Mindoro. It has 4.5 whorls, and measures: Height, 11.8 mm; greater diameter, 27.3 mm; lesser diameter, 23 mm.

Remarks.—The large extent of the malleations distinguishes this subspecies from all the others.

OBBA PLANULATA BONGABONA, new subspecies

PLATE 92, FIGURE 2

The shell is almost lenticular, the whorls being decidedly keeled; the succeeding ones falling below this keel to which they are appressed gives them a somewhat overhanging aspect. The last whorl is acutely keeled at the beginning, and quite strongly angulated behind the peristome. The first nuclear whorl is flesh-colored, the rest buff. The postnuclear whorls are flesh-colored, blotched, streaked, and vermiculated with brown on the upper surface. A narrow median, more or less interrupted brown band, is present, but evanesces on the last half

of the last whorl. The base is flesh-colored with an interrupted brown band one-third of the way between the summit and the suture anterior to the summit. The peristome is flesh-colored, while the inside of the outer lip is a purplish brown. The nuclear whorls have the usual fine incremental lines and spiral striations. The postnuclear whorls are strongly malleated on the anterior two-thirds of the turns on all but the last third of the last whorl. The postnuclear whorls are also marked on the upper surface by rather rough incremental lines and moderately strong incised spiral striations, those on the basal portion being a little more pronounced than those on the spire. Aperture broadly oval; peristome thickened and reflected, covering half of the umbilicus at the parietal wall. There is a strong tooth on the median portion of the inner lip.

Type.—The type, U.S.N.M. No. 382708, comes from the Quadras collection and was collected at Sitio Panlanau, Bongabon, Mindoro. It has 4.6 whorls, and measures: Height, 13.6 mm; greater diameter, 30.6 mm; lesser diameter, 24.4 mm.

Remarks.—Three additional specimens, U.S.N.M. No. 239845, were collected by Mr. Schultze at Bongabon. These yield the following data:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.6	26. 2	33. 3	14. 0
4.5	12. 4	31. 0	24. 2
4.5	13. 1	30. 3	25. 0

This subspecies in the character of malleations resembles *Obba planulata paluana*, from which it is at once distinguished by its much larger size and flatter form and less strong spiral sculpture. In its flat shape and angulated periphery of the early whorls it suggests *O. p. varaderoana*, from which its smaller size and less conspicuous spiral sculpture, as well as the less malleated base, distinguish it.

OBBA PLANULATA PALUANA, new subspecies

PLATE 93, FIGURE 1

The shell is depressed-helicoid with the periphery of the last whorl well rounded. The first nuclear whorl is flesh-colored, the succeeding turns pale brown. The postnuclear whorls are of flesh-colored ground color, spotted, streaked, and vermiculated with bright chestnut-brown. The last whorl is a little paler than the rest. A narrow median brown band encircles all the postnuclear whorls except the last fourth of the last turn. The base is flesh-colored, the vermiculations extending to the faint brown spiral line, which is at about one-third of the distance between the periphery and the umbilicus, anterior

to the periphery. The peristome is flesh-colored; the interior of the outer lip is brown. The first postnuclear whorl is marked by fine incremental lines and fine spiral striations; the succeeding ones, except the last half of the last turn, are strongly malleated on the anterior half and marked by feeble incremental lines and rather strong spiral striations on the upper surface, as well as on the base of the last whorl where the spiral striations are even stronger. On the first half of the last whorl of the base there are moderately strong malleations between the brown band and the periphery, the depressed portions being brown. The aperture is broadly oval; the peristome reflected, expanded, and thickened, covering about half of the umbilicus. The inner lip bears a conspicuous fold on its middle.

Type.—The type, U.S.N.M. No. 382888, is one of a series of specimens collected by Pedro de Mesa at Paluan, Mindoro. It has 4.9 whorls, and measures: Height, 13.1 mm; greater diameter, 27.9 mm; lesser diameter, 22.3 mm.

Remarks.—Ten additional specimens, U.S.N.M. No. 382889, from the same source yield the following information:

Number of whorls	Height	Greater diameter	Lesser diameter
	Mm	*Mm*	*Mm*
4.9	[1] 13. 1	[1] 27. 9	[1] 22. 3
4.8	13. 2	27. 6	21. 7
5.2	14. 5	27. 0	21. 6
5.2	13. 3	28. 6	21. 9
5.1	13. 1	26. 8	21. 0
5.0	12. 1	24. 0	19. 9
5.2	13. 8	25. 9	20. 8
5.2	14. 3	29. 4	22. 9
5.4	14. 2	26. 7	21. 8
4.9	13. 5	25. 8	20. 2
5.3	13. 0	26. 4	20. 9

[1] Type.

Two, U.S.N.M. No. 256408, collected by the United States Bureau of Fisheries *Albatross* Expedition, yield the following measurements:

5.3	14. 0	28. 6	22. 4
5.0	13. 7	27. 8	22. 4

U.S.N.M. No. 382890 contains a specimen collected by Pedro de Mesa at Tara, Abra de Ilog, Mindoro, which measures:

	5.0	13.2	26.3	20.8
Average	5. 107	13. 5	27. 06	21. 47
Greatest	5. 4	14. 5	29. 4	22. 4
Least	4. 8	12. 1	24. 0	19. 9

This species recalls *Obba planulata bongabona* as far as the general sculptural pattern is concerned, but the whorls are more rounded, and there is not the peripheral overhang that is present in *O. p. bongabona*, the last whorl being rounded rather than angulated.

OBBA PLANULATA MANSALAYANA, new subspecies

PLATE 93, FIGURE 2

The shell is moderately elevated with obsoletely angulated periphery. Nuclear whorls pale brown. The first postnuclear whorl is almost brown marked by a few axial streaks of pale buff, which is the ground color of the succeeding turns upon which also chestnut-colored blotches occupy a larger area than the ground color. On all the postnuclear whorls but the last one and a quarter an interrupted median chestnut-colored band is present. The base is pale buff with a broad interrupted spiral band of brown, which is about one-fourth of the distance between the periphery and umbilicus anterior to the periphery. The peristome is white, while the interior of the outer lip is brown with a purplish flush. The early postnuclear whorls are feebly malleated on their anterior half; these malleations disappear

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm.	*Mm.*	*Mm.*
	[1] 5. 2	[1] 14. 3	[1] 27. 4	[1] 21. 6
	5. 3	13. 4	28. 0	21. 8
	5. 4	12. 3	29. 2	22. 2
	5. 5	13. 6	28. 6	22. 4
	5. 2	13. 5	29. 5	23. 2
	5. 2	11. 5	25. 8	20. 7
	5. 4	13. 3	28. 5	22. 1
	5. 4	14. 4	27. 2	21. 2
	5. 3	13. 9	25. 9	21. 0
	5. 2	12. 0	28. 9	23. 3
	5. 5	13. 5	27. 5	22. 0
	5. 3	13. 0	29. 3	25. 0
	5. 4	11. 5	27. 0	21. 1
	5. 2	12. 1	26. 6	21. 1
	5. 4	13. 6	27. 4	21. 6
	5. 4	13. 6	29. 6	22. 7
	5. 1	13. 6	29. 1	22. 8
	5. 3	12. 5	28. 4	21. 6
	5. 2	13. 0	29. 0	22. 2
	5. 3	13. 9	30. 6	23. 3
	5. 4	14. 2	30. 2	22. 6
	5. 4	14. 8	28. 2	22. 5
	5. 3	14. 4	27. 6	22. 0
	5. 2	14. 0	30. 2	22. 8
	5. 5	14. 4	28. 2	22. 0
Average	5. 32	13. 372	28. 316	22. 192
Greatest	5. 5	14. 8	30. 6	25. 0
Least	5. 1	11. 5	25. 8	20. 7

[1] Type.

before the last whorl and a half are reached. The incremental lines are not strong, but the incised spiral lines are well developed and very regular both on the spire and base. The aperture is oval; the peristome, thickened and reflected, covers about half of the umbilicus at the parietal wall.

Type.—The type, U.S.N.M. No. 382705, and a lot of additional specimens, U.S.N.M. No. 256436, were collected by the writer on a hill on the west shore of Mansalay Bay, Mindoro. The type has 5.2 whorls, and measures: Height, 14.3 mm; greater diameter, 27.4 mm; lesser diameter, 21.6 mm.

Remarks.—Twenty-five specimens yield the data given in the table on page 367.

This subspecies, while it resembles *Obba planulata medioensis*, is easily distinguished from this by its smoother surface and the very conspicuous interrupted basal band.

OBBA PLANULATA MEDIOENSIS, new subspecies

PLATE 93, FIGURE 3

The shell is depressed-helicoid with the periphery of the last whorl obsoletely angulated. The nuclear whorls are dark buff; the whorl that succeeds them is brown, while the rest of the upper surface is of flesh-colored ground color, blotched, spotted, and vermiculated with dull chestnut-brown. On all the postnuclear whorls a somewhat darker interrupted zone marks the obsolete peripheral angle. The base is soiled flesh-color with a moderately broad, interrupted, ill-defined, dark band about one-third of the distance between the periphery and umbilicus anterior to the periphery. The space between this band and the periphery is indistinctly marked with a few streaks of brown. The peristome is flesh-colored with a brownish flush, while the inside of the outer lip is pale brown with a purplish wash. The postnuclear whorls are weakly malleated on the anterior half, except the last turn where this character fades out. The postnuclear whorls are also marked by rather coarse and irregular incremental lines and strongly incised wavy spiral lines, which are present on both spire and base. Aperture moderately large, oval; peristome reflected over about one-third of the umbilicus. Tooth on the inner lip strongly developed.

Type.—The type, U.S.N.M. No. 382704, and a lot of additional specimens, U.S.N.M. No. 256438, were collected by myself on Medio Island in Galera Bay, off northeast Mindoro. The type has 5.2 whorls, and measures: Height, 13.8 mm; greater diameter, 28.4 mm; lesser diameter, 22.6 mm.

Remarks.—Twenty-five specimens yield the following data:

	Number of whorls	Height	Greater diameter	Lesser diameter
		Mm	*Mm*	*Mm*
	5. 2	13. 4	28. 2	22. 0
	5. 1	14. 9	29. 2	23. 0
	5. 4	14. 7	28. 4	22. 9
	5. 3	13. 7	28. 7	22. 6
	5. 2	13. 3	26. 9	21. 6
	5. 4	15. 1	29. 6	23. 3
	5. 2	13. 5	28. 6	23. 4
	5. 3	14. 2	28. 9	22. 8
	5. 0	13. 0	28. 0	22. 7
	5. 1	13. 0	27. 8	22. 5
	5. 2	14. 1	28. 9	22. 6
	5. 5	14. 2	28. 6	23. 0
	5. 2	13. 7	29. 0	23. 1
	5. 2	13. 5	29. 3	23. 4
	5. 2	13. 0	28. 1	22. 0
	5. 1	12. 7	29. 0	22. 9
	[1] 5. 2	[1] 13. 8	[1] 28. 4	[1] 22. 6
	5. 3	13. 2	29. 2	23. 2
	5. 2	15. 5	28. 7	22. 9
	5. 2	13. 2	28. 4	22. 6
	5. 2	13. 9	28. 9	23. 4
	5. 1	13. 3	28. 8	23. 5
	5. 5	14. 8	29. 3	23. 9
	5. 3	14. 0	29. 7	23. 8
	5. 3	12. 8	28. 3	22. 9
Average	5. 236	13. 78	28. 676	22. 9
Greatest	5. 5	15. 5	29. 7	23. 9
Least	5. 0	12. 7	26. 9	21. 6

[1] Type.

The present subspecies resembles most nearly *Obba planulata mansalayana*, but can at once be distinguished from it by the practical absence of the basal spiral zone.

OBBA PLANULATA MANGARINA, new subspecies

PLATE 93, FIGURE 4

The shell is broadly conic and its last whorl obtusely angulated. The first nuclear whorl is flesh-colored, the next straw-colored; the first postnuclear whorl is bright chestnut-brown, the rest are of flesh-colored ground color, spotted and vermiculated with brown. In fact the chestnut-brown coloration is so strong that it overshadows the lighter flesh-colored elements and might well be considered the major color scheme. A narrow median brown band, a little deeper than the rest of the brown coloration of the upper surface, marks the middle of the postnuclear whorl, except the last fourth of the last turn. The base is flesh-colored, spotted and mottled with brown; the peristome is white, while the interior of the outer lip is purplish brown. The anterior two-thirds of the postnuclear turns are strongly malleated. These malleations evanesce at about the termination of the next

to the last whorl. The postnuclear whorls are marked by rather rough and somewhat irregular incremental lines and moderately strong, well-incised, spiral striations. The base of the last whorl is malleated; the impressed portions being brown lend to it a peculiar color pattern. It is also marked by the continuations of the incremental lines and spiral striations, which are a little stronger than those on the upper surface. Aperture ovate; peristome broadly expanded and reflected, half covering the umbilicus at the parietal wall. The inner lip has a conspicuous tooth on its middle.

Type.—The type, U.S.N.M. No. 382709, comes from the Quadras collection and was collected at Sitio, Lalangan, Mangarin, southern Mindoro. It has 4.8 whorls, and measures: Height, 14.9 mm; greater diameter, 28 mm; lesser diameter, 21.5 mm.

Remarks.—This shell in shape and coloring resembles most nearly *Obba planulata cagurayana*, with which it is also geographically most nearly approximated, but it is at once distinguished by its much rougher sculpture both on spire and base.

OBBA PLANULATA VERDENSIS, new subspecies

PLATE 93, FIGURE 6

The shell is depressed-helicoid. The early whorls are of dark buff and the later of flesh-colored ground color. A conspicuous median bright chestnut-brown band, which is almost complete, is present on the upper surface. A second, but a little more interrupted, band is present at the angulated periphery. In addition to these bands, the upper surface of the whorls is marbled and axially streaked with brown. The basal surface is flesh-colored with an interrupted zone of brown about as distant from the periphery as the median band on the upper surface of the whorl is distant from it. The peristome is white. All but the last postnuclear whorls are malleated on the anterior half of the turns. In the same area they are also marked by rather strongly incised spiral lines, but these weaken decidedly on the last whorl. The incremental lines are irregular and rather coarse, even on the lower surface. On the base the incised spiral lines are stronger than on the upper surface. The aperture is large, oval, with the peristome thickened and reflected, covering one-third of the umbilicus at the parietal wall. The median basal tooth of the inner lip is quite strongly developed.

Type.—The type, U.S.N.M. No. 256550, was collected by Col. Edgar A. Mearns on Verde Island off northeast Mindoro. It has 5 whorls, and measures: Height, 12.3 mm; greater diameter, 32.2 mm; lesser diameter, 24.9 mm.

Remarks.—This is a large, flat, bright-colored race, which has a conspicuous interrupted basal color band. The malleations do not extend upon the last turn, on which the spiral striation is not strongly developed

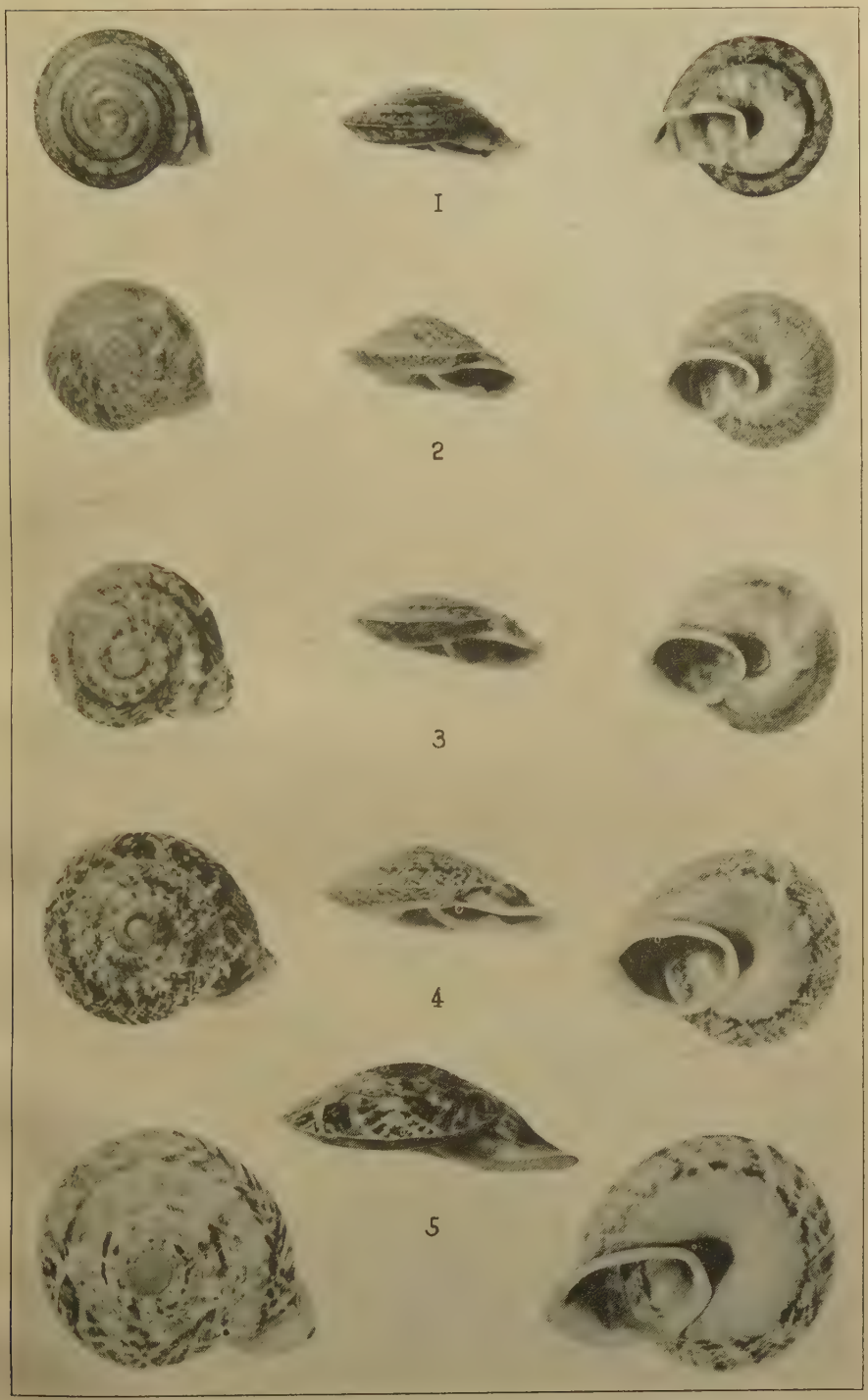
OBBA PLANULATA CAGURAYANA, new subspecies

PLATE 93, FIGURE 5

The shell is broadly conic and weakly angulated at the periphery of the last whorl. The first nuclear whorl is pale buff, the rest deeper buff. The first postnuclear whorl is chestnut-brown, which is also the color of the remaining turns. In addition to this, the whorls are marked by more or less zigzag or interrupted axial lines and dots of flesh-color. There is a narrow median brown band on all the whorls, which extends to the peristome on the last turn. The base is pale brown with a deeper brown band about one-third of the distance between the periphery and the umbilicus anterior to the periphery. The postnuclear whorls in the young shell are strongly keeled, and the succeeding turns drop below this keel to which they are appressed. All but the last one and one-third turns are feebly malleated on the anterior half. The postnuclear whorls are marked by rather regular, weak, retractively curved incremental lines and exceedingly fine spiral striations on the upper surface. On the base of the last whorl these spiral striations become more pronounced. The aperture is broadly oval; the peristome is strongly reflected and thickened, covering half the umbilicus at the parietal wall. The inner lip has a conspicuous tooth on its middle.

Type.—The type, U.S.N.M. No. 382887, was collected by C. Canonizado at Caguray. It has 5 whorls, and measures: Height, 13.6 mm; greater diameter, 26.9 mm; lesser diameter, 21.3 mm.

Remarks.—This species most nearly resembles *Obba planulata mangarina*, from which it can at once be distinguished by its much smoother sculpture.



SUBSPECIES OF OBBA GALLINULA AND O. LISTERI

1, *Obba gallinula barthelowi*, new subspecies; 2, *O. listeri sibolonensis*, new subspecies; 3, *O. l. halcona*, new subspecies; 4, *O. l. campoensis*, new subspecies; 5, *O. l. listeri* (Gray). Natural size.

SUBSPECIES OF OBBA LISTERI

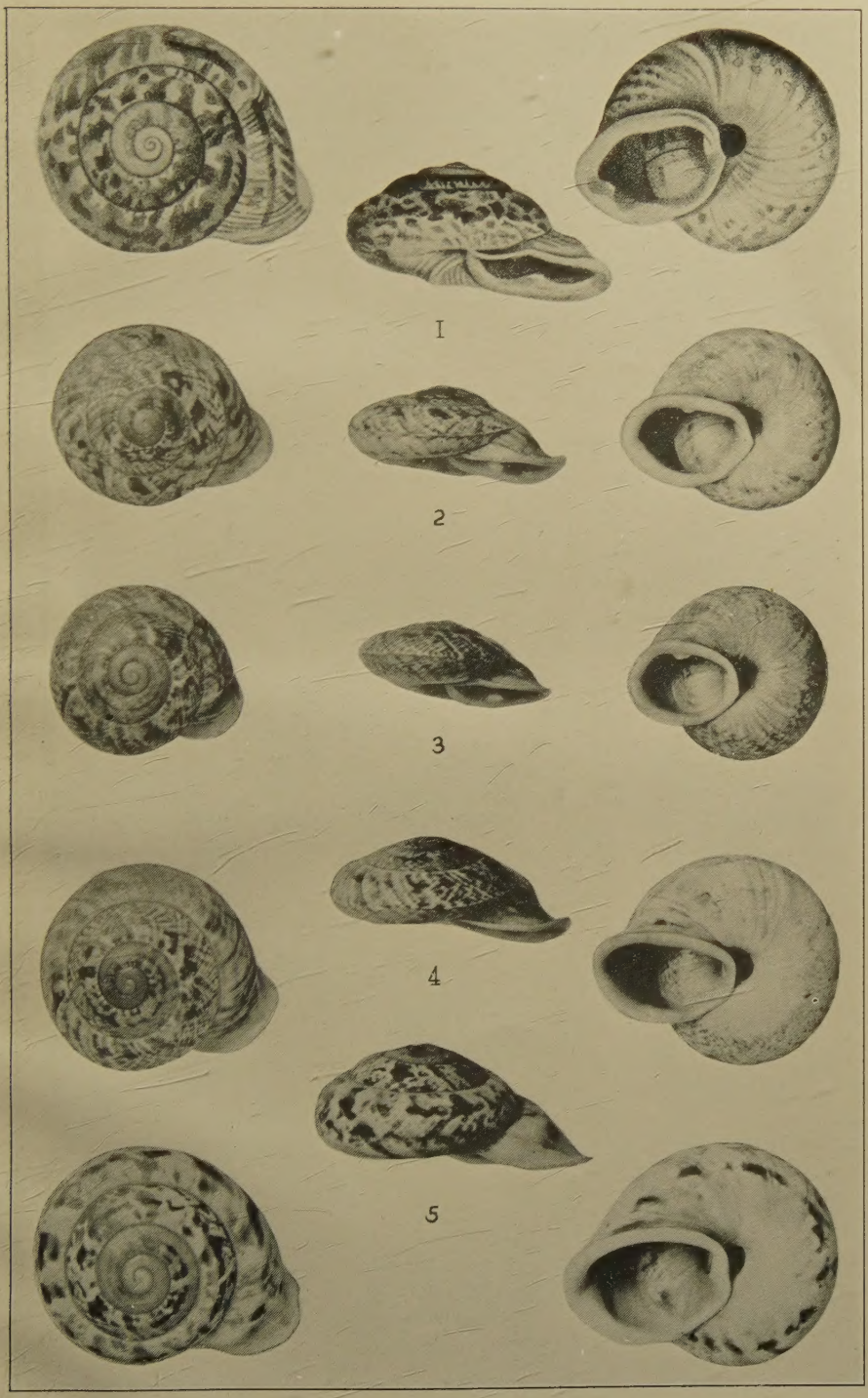
1, *Obba listeri mayabigana*, new subspecies; 2, *O. l. minor* (Möllendorff); 3, 4, *O. l. recurvata* (Möllendorff); 5, *O. l. smithi*, new subspecies. Natural size.

FORMS OF FOUR SPECIES OF OBBA

1, *Obba listeri caloocana* new subspecies; 2, *O. l. subplanulata* (Möllendorff); 3, *O. subhorizontalis radcliffei*, new subspecies; 4, *O. marmorata ilinensis* Bartsch; 5, *O. sarcochroa ilogana*, new subspecies. Natural size.

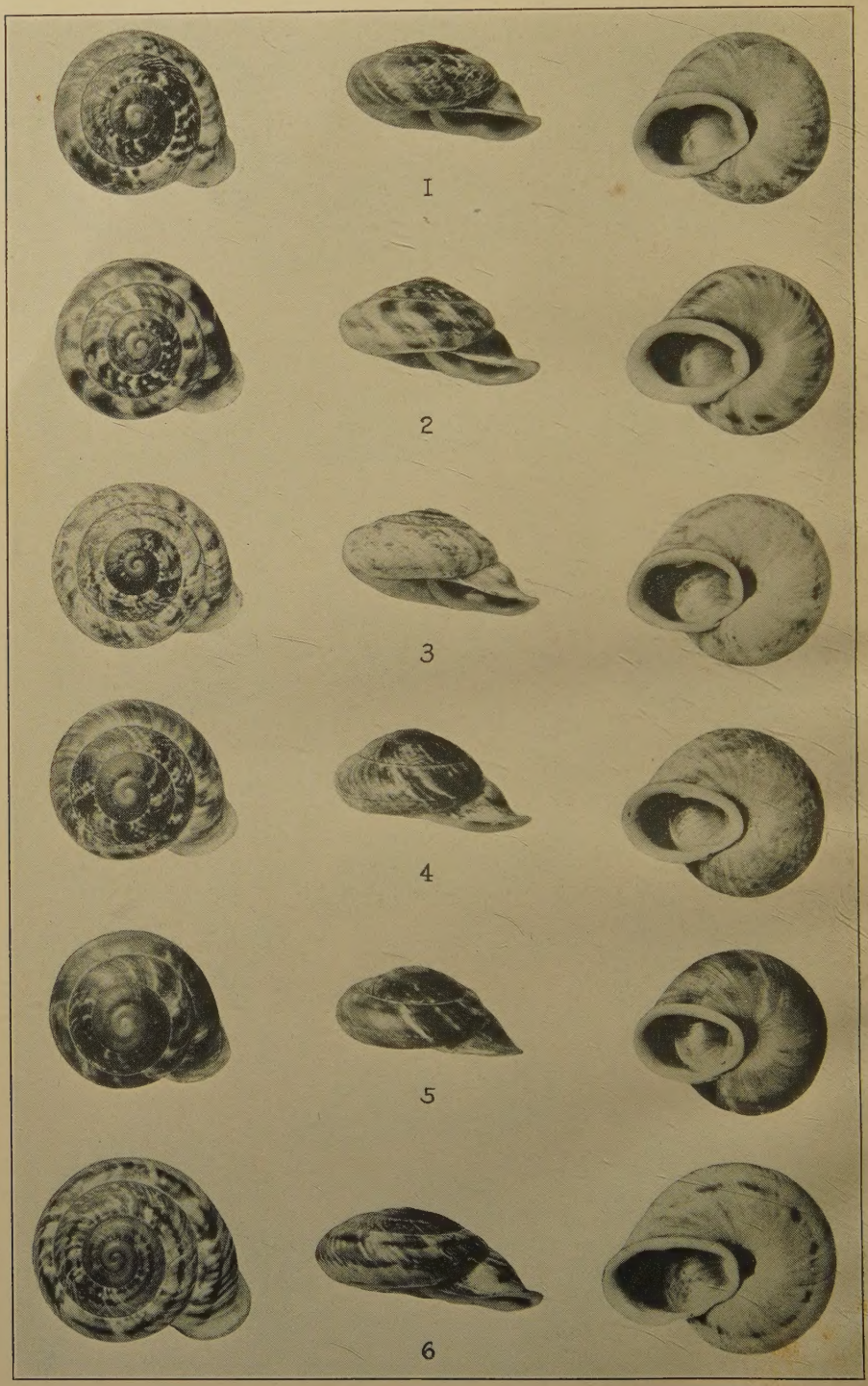
SUBSPECIES OF OBBA MESAI, NEW SPECIES, AND O. PLANULATA

1, *Obba mesai richi*, new subspecies; 2, *O. m. mesai*, new subspecies; 3, *O. m. sablayana*, new subspecies; 4, *O. m. johnsoni*, new subspecies; 5, *O. planulata lubangensis*, new subspecies. Natural size.



SUBSPECIES OF OBBA PLANULATA

1, *Obba planulata planulata* (Lamarck), copy of Férussac's figures; 2, *O. p. bongabona*, new subspecies; 3, *O. p. salcedoi*, new subspecies; 4, *O. p. varaderoana*, new subspecies; 5, *O. p. planulata* (Lamarck). Natural size.



NEW SUBSPECIES OF OBBA PLANULATA

1, *Obba planulata paluana;* 2, *O. p. mansalayana;* 3, *O. p. medioensis;* 4, *O. p. mangarina;* 5, *O. p. cagurayana;* 6, *O. p. verdensis.* Natural size.